



Federal Aviation
Administration



Next**GEN**

NEXTGEN WORKS
FOR GENERAL AVIATION



GENERAL AVIATION: GREATER ACCESS TO NEXTGEN BENEFITS

Tom Haines, editor-in-chief of *AOPA Pilot* magazine for the Aircraft Owners and Pilots Association, owns a Bonanza. In 2013 he had a close call while flying that could have been worse without NextGen avionics.

A few months after installing a \$3,000 Automatic Dependent Surveillance–Broadcast ([ADS-B](#)) unit in his aircraft, Haines was flying with an instructor

in western Maryland for instrument proficiency. Haines was focused on the instrument panel and the instructor had not spotted a Cessna 172 approaching the Bonanza's position.

An audio alert called out the direction and relative level of the traffic. A moving map displayed its location. The instructor, knowing where to look, spotted the Cessna 172 headed straight toward them and told Haines to climb.

“The 172 went by right underneath us. It was very close and I think he would have hit us had I not climbed. He never saw us,” said Haines.

Fortunately, Haines had upgraded his Bonanza with both ADS-B In and Out capabilities. ADS-B Out broadcasts his aircraft's position. ADS-B In shows on

a cockpit display the location of other aircraft flying nearby. In this case an alert sounded out “traffic, 12 o’clock.” The alert adds “high” or “low” if the other aircraft is at a different altitude.

“This allows you to immediately get your eyes outside without even having to look at the moving map,” Haines said.

Haines wanted to equip his aircraft with optional ADS-B In avionics to receive the traffic alerts. Aircraft flying in most controlled airspace are mandated to have ADS-B Out by January 1, 2020.

As Haines learned, ADS-B and satellite-based procedures are rapidly improving the safety and reliability of general aviation. These widely available systems gained even more ground over the past year.

ADS-B PROGRESS

As illustrated above, ADS-B can provide unprecedented levels of situational awareness for general aviation pilots. The traffic picture displayed in the cockpit of ADS-B In-equipped aircraft includes position information reported by ADS-B Out as well as radar. This data is sent to the cockpit via air-to-air reception, or relay from the ground. The roughly once-per-second ADS-B Out broadcast rate is not only automatic, but also depends on equipment on the aircraft for air traffic surveillance to occur — thus the cooperative and dependent nature of ADS-B.

Additional benefits are available to general aviation aircraft owners who decide to equip their aircraft

with ADS-B In. In addition to receiving traffic information, general aviation aircraft equipped with Universal Access Transceivers (UAT) operating on a frequency of 978 megahertz (MHz) can receive and display weather and other aeronautical information from FAA broadcasts. This information will enhance pilots’ situational awareness of in-flight hazards and help prevent accidents.



ADS-B In enhances safety for general aviation pilots by delivering traffic, weather and other flight information directly to the cockpit.

Three types of FAA broadcast services provide benefits to pilots of ADS-B In-equipped aircraft:

- Traffic Information Service–Broadcast (TIS-B): This air traffic advisory service provides the altitude, ground track, speed and distance of aircraft flying in radar contact with controllers and within a 15-nautical-mile (nm) radius, up to 3,500 feet above or below the

receiving aircraft’s position. A general aviation aircraft equipped with ADS-B In can also receive position data directly from other aircraft broadcasting on the same ADS-B Out frequency. In addition, TIS-B enables pilots to see aircraft equipped with transponders flying nearby even if those aircraft are not equipped with ADS-B Out.

- Automatic Dependent Surveillance–Rebroadcast (ADS-R): ADS-R takes position information received on the ground from UAT-equipped aircraft and rebroadcasts it on the 1090 MHz frequency. Likewise, ADS-R rebroadcasts 1090 MHz data to UAT users. In concert with TIS-B, ADS-R provides all ADS-B In-equipped aircraft with a

comprehensive airspace and airport surface traffic picture. ADS-R delivers traffic data within a 15-nm radius 5,000 feet above or below relative to the receiving aircraft's position.

- **Flight Information Service–Broadcast (FIS-B):** This service broadcasts graphical weather to the cockpit based on what ground-based weather radar is detecting. In addition, FIS-B broadcasts text-based advisories including Notice to Airmen messages and reports on everything from significant weather to thunderstorm activity. UAT-equipped general aviation aircraft can receive this information at altitudes up to 24,000 feet.

The FAA has completed the baseline deployment of more than 600 ADS-B ground stations, making TIS-B, ADS-R and FIS-B services available across the United States. That makes ADS-B In an attractive option for general aviation. Aircraft owners and operators now have the opportunity to be early adopters of ADS-B technology and to be among the first to take advantage of its benefits years before the ADS-B Out mandate takes effect.

The availability of rule-compliant avionics from various manufacturers is increasing, and the agency has completed advisory circular guidance so the general aviation community can install required avionics. ADS-B In avionics are also starting to appear on the market for situational awareness applications and flight information services.



NextGen at Snoopy's Airport

NextGen provided Charles M. Schulz-Sonoma County Airport with a safety blanket — a procedure that enables pilots of equipped aircraft to land even when the approach to the runway is covered in fog.

For more on this story, visit our [NextGen Performance Snapshots website](#).

NextGen traffic and weather information will also be available for display on some mobile devices at a time when many general aviation pilots own and use tablets. Complete TIS-B and ADS-R reports, however, will only be broadcast to the cockpits of general aviation aircraft equipped to report their position over ADS-B Out.

The FAA is also exploring the possibility of setting standards for battery-powered ADS-B Out transmitters that can be used on gliders and general aviation aircraft certificated without an electrical system. Additionally, the FAA is working with the aviation community to set standards for how ADS-B In provides pilots

with a low-cost traffic alerting capability. Flight testing for the standards began in 2013. The traffic alert application uses ADS-B data to identify conflicting traffic nearby, alerting the pilot to look out the window and see the traffic being called out.

WAAS PROGRESS

Wide Area Augmentation System (WAAS)-enabled NextGen procedures are making it possible for general aviation pilots to file and fly to a greater number of airports during low visibility. When rising terrain is an issue near an airport, precise vertical guidance enhances safety regardless of visibility and whether the approach is being flown during the day or at night.

As of April 2014, the FAA has published 3,402 WAAS-enabled approach procedures that feature Localizer Performance with Vertical Guidance (LPV) minima at 1,675 airports. The latest information is available on the FAA's [Satellite Navigation Program website](#).

More than 65,000 general aviation aircraft are equipped with the WAAS receivers needed to fly WAAS-enabled procedures with LPV minima or WAAS-enabled non-precision approach procedures with Localizer Performance (LP) minima.

WAAS enables the FAA to design Area Navigation (RNAV) (GPS) procedures with LPV minima, offering capability similar to Instrument Landing System (ILS) with vertical guidance and decision altitudes as low as 200 feet. Because nearly half of these

RNAV (GPS) approaches with LPV minima are to airports that have no ILS, pilots are now able to access these destinations when visibility is limited, rather than ruling them out. An airport must have at least 3,200 feet of paved runway to qualify for an RNAV (GPS) procedure with either LP or LPV minima.

New York pilot Mike Hall, a retired U.S. Air Force major general and a general aviation pilot who flies for business and pleasure, likes to fly the RNAV (GPS) 32 instrument approach procedure with LPV minima at his home base in Ithaca, N.Y., even though there is an ILS to that runway. With his WAAS-equipped Mooney, Hall finds the satellite-enabled guidance rock steady while the ILS signal can waver. In addition, he can pick up the course to the runway with WAAS from 30 nm out, whereas the ILS is less accurate the farther you go from the ground-based antenna on the airport.

And when the ILS is out of service, such as for maintenance, Hall can still land in low visibility conditions, which are frequent in upstate New York. Having an ILS listed as “navaid out” would otherwise mean Hall and the dozens of other general aviation pilots with aircraft based at Ithaca would have no luck getting home without WAAS avionics.

Many of the other airports Hall visits during his roughly 250 flight hours a year have no ILS, but if they have an LPV procedure, he’s happy.

“When you think about going to an airport, it is nice if that place

has an approach such as RNAV (GPS) with LPV with a decision altitude as low as 200 feet if you are trying to keep a schedule,” Hall said.



LPV approach procedures provide general aviation operators with greater all-weather access to more airports nationwide.

The agency will publish 275 additional LPVs and LPs by 2016 if enough runways are found to be suited for these procedures.

The FAA has also published 538 RNAV (GPS) non-precision procedures as of April 2014, with LP minima that employ WAAS for lateral guidance but without the added safety benefit of vertical guidance. These approaches are needed at runways where obstacles or other infrastructure limitations prevent the FAA from publishing a vertically guided approach. Non-precision LP minima are generally higher than LPV minima.

As part of NextGen, the FAA plans to meet any new requirements for Category 1 approach procedures with WAAS

and LPV while maintaining an existing network of ILS systems to provide alternative approach and landing capability. The agency also intends to transition from defining airways, routes

and procedures using VOR so that RNAV using GPS and other positioning information is available everywhere in the National Airspace System. A network of Distance Measuring Equipment stations and a minimum operational network of VOR stations will be maintained to ensure safety and continuous operations for high- and low-altitude en route airspace over the continental United States. For an overview of the Performance Based Navigation (PBN) transition and links to WAAS and other PBN information, see the [NextGen Get Smart About Performance Based Navigation sheet](#).

WAAS receivers are certified under the supplemental type certificate (STC) method,

which covers either a model of aircraft or an individual aircraft. Approximately 5,000 business jets and turboprops have [WAAS](#) receivers under STC approval. Many other instrument-flight-capable general aviation aircraft have panel-mounted GPS receivers and moving map displays, which have enhanced safety over the past decade. Thousands of general aviation pilots also use non-FAA certified, portable GPS receivers for situational awareness.

The widespread and growing availability of LPV and LP procedures and the high equipage rate in the general aviation fleet is making it possible for the FAA to retire some ground-based navigation aids from service, including Nondirectional Beacon (NDB) and VOR equipment. Many general aviation aircraft owners have removed the now obsolete avionics needed to fly an NDB procedure and the FAA continues to shut down NDBs on the ground. LPV procedures provide lower minima than are available with NDB approaches.

UNLEADED FUEL PROGRESS

As part of the NextGen fuels effort, the FAA has been working closely with the Environmental Protection Agency, environmental groups and industry stakeholders — including aviation associations, aircraft and engine manufacturers and fuel suppliers — to facilitate the development of an unleaded replacement fuel for piston-powered aircraft.

The goal of the effort is to make available by 2018 an unleaded

alternative to 100 octane low-lead fuel. In addition to the obvious environmental benefits of operating with a replacement fuel that contains no lead, this effort will support the growth of

resolve these issues. In February 2012, the rulemaking committee published its final report. One of the key challenges identified is developing a replacement fuel that both low- and high-performance



The FAA is working with environmental and industry stakeholders to produce an unleaded replacement fuel for piston-powered aircraft.

the general aviation fleet and the introduction of new and safer aircraft.

Lead has been used as an additive to fuel because it enables high-performance aircraft engines to operate smoothly without experiencing damaging knocking that could lead to engine failure.

It appears unlikely that an unleaded replacement fuel will be a drop-in solution — meaning changes may be required to current engine and aircraft designs as well as operating instructions. In January 2011, the FAA chartered the Unleaded Avgas Transition Aviation Rulemaking Committee. This government and industry collaborative group was formed to investigate issues relating to the unleaded fuel transition and to recommend the tasks necessary to investigate and

piston-powered aircraft can safely use.

In response to the rulemaking committee, the FAA established the Fuels Program Office in 2012 to oversee the transition to unleaded fuel. This move enables the FAA to centralize aviation fuel expertise in one office that can more effectively support industry initiatives and the associated fuels certification projects relating to unleaded aviation gasoline.

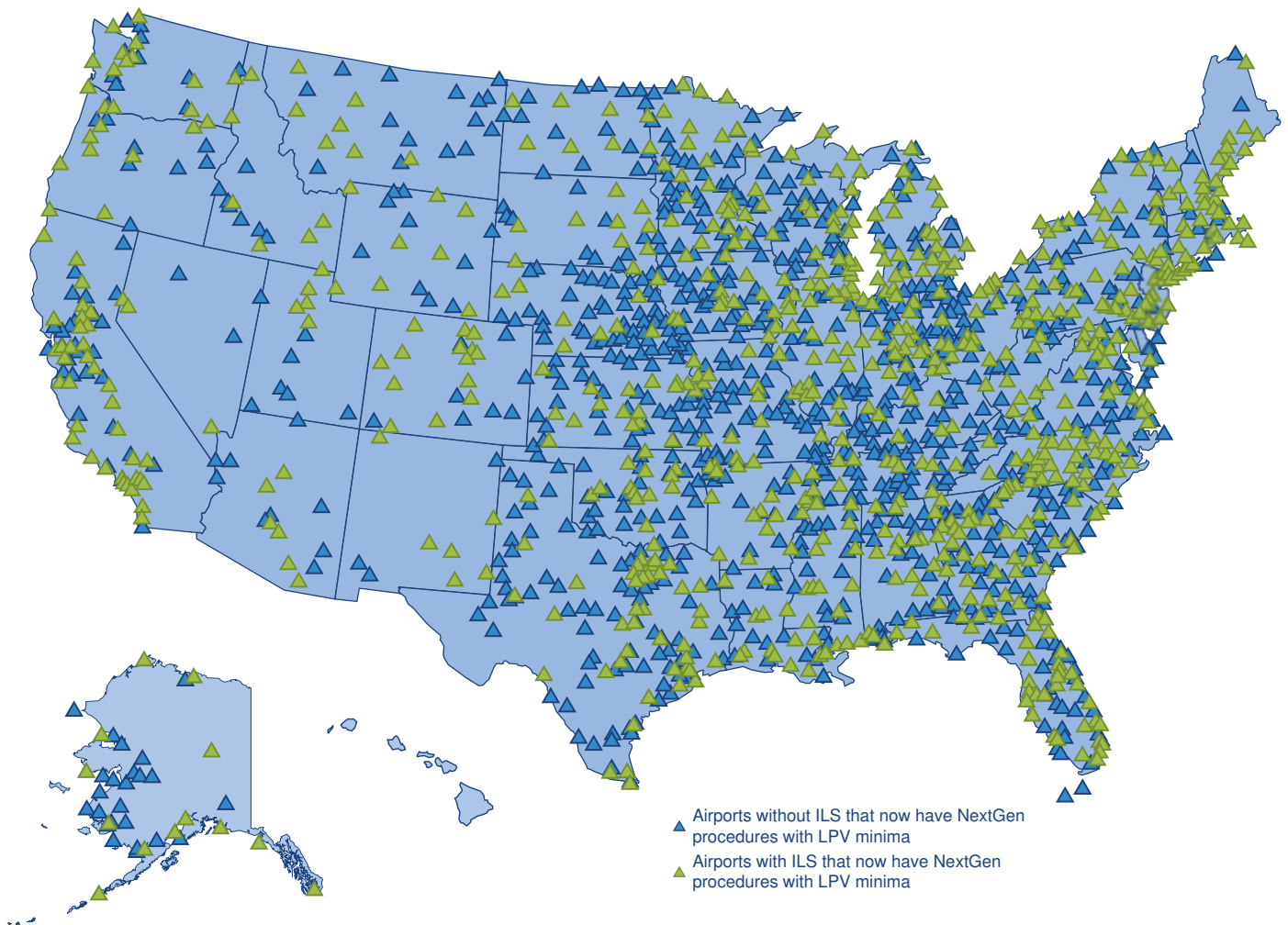
In 2013, the FAA expanded this office to include the Fuels Program Branch, which will oversee and provide standardization for fuels certification activities. The agency also responded to the FAA Modernization and Reform Act of 2012 by publishing a [report](#) detailing a research and development plan to identify,

test and qualify the best-performing unleaded aviation fuel available and to safely transition the fleet of piston engine aircraft to that fuel. The FAA is committed to support this research and development plan at the FAA William J. Hughes Technical Center in Atlantic City, N.J., with extensive laboratory, rig, engine and aircraft testing.

In May 2013, the FAA and industry trade associations established a government-industry group — the

Piston Alternative Fuels Initiative Steering Group — to facilitate collaboration on the development and deployment of a high octane fuel that will have the least impact on the existing general aviation fleet and distribution system. Then in June 2013, the FAA issued a request to interested parties for fuel formulations that might be tested in the fuels evaluation program at the Technical Center.

Improving General Aviation Access with NextGen Approaches as of February 2014



With the advent of NextGen procedures, it has gotten easier for general aviation pilots to file and fly to airports during low-visibility conditions. If an aircraft is equipped with GPS and WAAS to correct for errors, the pilot can now fly an RNAV (GPS) approach using LPV minima at more than 1,600 airports, many of which do not have ILS.

About 25 percent of the LPV approaches the FAA has published have minima as low as 200 feet, the same as an ILS Category 1 approach.



Learn More at the NextGen Website
www.faa.gov/nextgen



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Why **NextGEN** Matters

The movement to the next generation of aviation is being enabled by a shift to smarter, satellite-based and digital technologies and new procedures that combine to make air travel more convenient, predictable and environmentally friendly.

As demand for our nation's increasingly congested airspace continues to grow, NextGen improvements are enabling the FAA to guide and track aircraft more precisely on more direct routes. NextGen efficiency enhances safety, reduces delays, saves fuel and reduces aircraft exhaust emissions. NextGen is also vital to preserving aviation's significant contributions to our national economy.

- NextGen provides a better travel experience, with less time spent sitting on the ground and holding in the air.
- NextGen gets the right information to the right person at the right time.
- NextGen reduces aviation's adverse environmental impact.
- NextGen lays a foundation for continually improving and accommodating future air transportation needs while strengthening the economy locally and nationally.
- NextGen increases airport access, predictability and reliability.
- NextGen enables us to meet our increasing national security and safety needs.
- NextGen safety management helps us to proactively identify and resolve potential hazards.
- NextGen brings about one seamless, global sky.